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TECHNICAL MEMORANDUM

(TM Series)

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1604 Simulation Program Descriptions

Milestone 11

The Simulated Telemetry Data Generation Control Program (STGR)

by

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15 March 1963

Approved
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1.0 IDENTIFICATION

1.1 Title

STGR - Ident K07, Mod. 03

1.2 Programmed

15 December 1962, J. Ng, System Development Corporation

1.3 Documented

5 February 1963, J. Ng, System Development Corporation

2.0 PURPOSE

The Simulated Telemetry Data Generation Control Program (STGR) has been designed to provide realistic telemetry data (Fixed Format and Event Items) under card input control. The simulated data will be packed in the same format as the Telemetry Report Message (Message Type #13). In the present version, only the FM/FM telemetry data is simulated. Additional capability to simulate PAM and PCM telemetry data (exclusive of special vehicle-specific payload telemetry) will be incorporated (if desirable) at a future date, when adequate information is available.

3.0 USAGE

3.1 Introduction

The STGR program is an integral part of the Simulated Input Preparation System for Augmentation (SIPSA). Simulated telemetry data is generated by Request Cards, containing identifying information and parameters necessary to define uniquely an operational telemetry mode. The output of this program is a simulated telemetry report message which can be used as a simulated input, via the "Simulated" tracking station 160-A Computer, to the Bird Buffer at the STA. (See Appendix A for STGR Logic Flow.)

3.2 Input

3.2.1 Parameters

a. Telemetry Mode Selection (P1)

This parameter is a 4-digit octal number used to identify an operational telemetry mode.

b. Telemetry Item Specifications

A maximum number of three parameters must be specified to describe an "Event" item. If the item is to be reported as "Fixed Format", then only one parameter is necessary (P3). These parameters, in groups of three's, are repeated as often as the number of items are necessary for this mode. Each of these parameters are defined as follows:

1) "Event" Ident (P2)

This parameter is a 4-digit octal number, with the leading digit set to zero, to identify this "Event" item. If the item is to be reported as "Fixed Format", this parameter field must be blank.

2) Function Specification (P3)

This parameter is used by the STGR program to identify the appropriate function, utilized to generate telemetry data, and the associated algorithm applied to this data point. This parameter must be specified for each item. If the item is an "Event" item, the next parameter must be specified. If this parameter field is blank, the program will assume that there are no more items following.

3) "Event" Report (P4)

This parameter is used by the "Event" processing algorithm applied to this item. This field must start with a "T", "N", or "V", followed by an octal number, n, (where $1 < n < 7777$). This octal number, n, is identified as time in seconds between reports, if preceded by "T"; as a "Threshold" value, if preceded by "N"; and as the number of bits repeated, if preceded by "V". This field must be punched if the item is an "Event" item.

c. Paper-Tape Option (I.O.S.) (P5)

If the pre-selected tracking station is the Indian Ocean Station, then the telemetry report will be punched on a 5-level paper tape and each report will be updated by the number of seconds specified by P5. Paper tape output is not dependent on station number.

The following table (Item Specification Table) should be helpful to the user when preparing input cards.

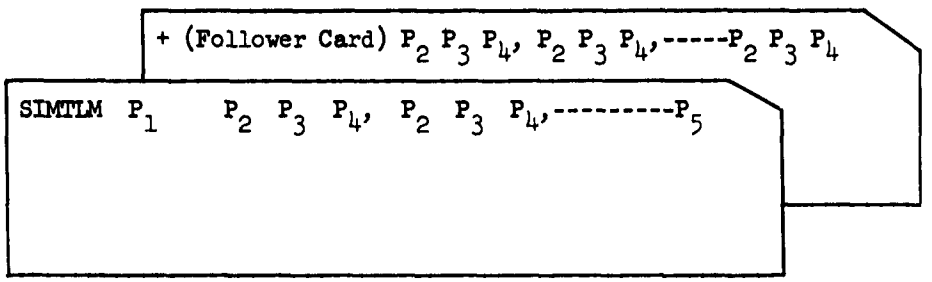
ITEM SPECIFICATION TABLE

FUNCTION	EVENT			FIXED FORMAT	DATA GENERATION MODULE	TYPE OF DATA	MAX. NO. OF BITS
P_3	PROC. ALGORITHM	P2 IDENT	P4 CRITERIA	PROC. ALGORITHM			
XXS	1	OCTAL	N-n(N)	Not Used	Step	OCTAL	8
XXL	2	OCTAL	T-n(T)	2	Steady State	OCTAL	8
XXL	3	OCTAL	T-n(T)	3	Steady State	OCTAL	8
B	4	OCTAL	T-n(T)	4	Steady State	4-BIT BCD	4
C	5	OCTAL	T-n(T)	5	Steady State	4-BIT BCD	4
V	6	OCTAL	V-n(V)	Not Used	Constant	OCTAL	16
XXW	2	OCTAL	T-n(T)	2	Dynamic	OCTAL	8
XXW	3	OCTAL	T-n(T)	3	Dynamic	OCTAL	8

XX ⟶ This represents some number ranging from 0-9. The number identifies one of the ten variable patterns provided within each Data Generation Module. These variations will be presented in a table form under "Algorithm Method".

3.2.2 Input Function Card Format

The input parameters described above are input to the SIPSA system by punched cards. In addition, certain system control cards are necessary (see Operating Instructions, Milestone 7, TM-(L)-734/022/00). A maximum of 44 input cards can be input to SIPSA to describe a telemetry mode. Each follower card must have a "plus" sign punched in Column 1. If the telemetry report is to be punched on paper tape (I.O.S.), then Column 80 of the first card must be punched with the time interval (in seconds) between reports (1-9). The input function card format is illustrated as follows:



Columns	Content	Description
1-8	SIMTLM	Telemetry Request function identification, left justified with trailing blanks.
12-15	P_1	Telemetry mode, octal number, right justified ($0 \leq P_1 < 7777$).
17-20) 33-36) 49-52) 65-68)	P_2	"Event" item ident, octal number with a leading zero. If the item is "Fixed Format", this field must be blank.
22-24) 38-40) 54-56) 70-72)	P_3	Type of telemetry function. The last column of this field specifies the data generation module; the preceding decimal number (0-9) specifies one of the ten variations.
27-31) 43-47) 59-63) 75-79)	P_4	This field must be punched if the item is an "Event" item. This field begins with a T, N, or V, followed by an octal number, n,($1 < n < 7777$).
80	P_5	This column equals the time interval in seconds between reports, if paper tape output (5-level) is requested. P_5 is specified only on the first card.

The input parameters P_2, P_3, and P_4 are repeated, if necessary, by follower cards with a "plus" sign in Column 1.

3.3 Errors, Stops and Recovery Procedures

In the process of generating telemetry data, the STGR program performs certain legality checks on the input parameters. If errors are detected, the program will stop. On-line printouts are provided with recovery procedures. There are two types of on-line printouts provided. The first type is a "Comment" printout, which is recoverable, and the second type is an "Error" printout, which is non-recoverable.

3.3.1 Comment Printouts

a. The following printout is provided when the program is ready to start punching paper tape. The message on the printer will read:

> ENABLE PAPER TAPE PUNCH FOR TELEMETRY. CHECK TO BE SURE THE PAPER TAPE IS 5-LEVEL.....PUSH ON.

b. The following printout is provided when the program has finished punching paper tape for one pass. The message on the printer will read:

> ALL TELEMETRY DATA HAS BEEN PUNCHED....PUSH ON.

c. The following printout is provided when the program has detected that one or more of the telemetry item specifications is out of sequence (i.e., a "Fixed Format" item is specified after an "Event" item). The message on the printer will read:

> INPUT PARAMETER FOR TELEMETRY IS OUT OF SEQUENCE.
> HIT START TO CONTINUE.

Upon recovery, the telemetry item that is out of sequence will be corrected by the STGR program. If a "Fixed Format" item is found after an "Event" item, the program will place this "Fixed Format" item behind the last "Fixed Format" item in a sequence table.

3.3.2 Error Printouts

When an error is found on an input card (parameters punched in the wrong column or mispunched), one of the following two messages will be printed and the program stops with no recovery.

a. THERE IS AN ERROR ON A TELEMETRY SPECIFICATION CARD. RETURN JOB TO PROGRAMMER FOR CORRECTION.

b. THERE ARE ILLEGAL CHARACTERS IN A CARD FIELD BEING CONVERTED TO BINARY. IF THE CARD CAN BE CORRECTED, DO SO, THEN RESTART.

3.4 Output

Two types of output are provided by STGR. One type is to be transferred through the Digital Data Line; the other is punched on 5-level paper tape. The output of the first type is packed in the exact format as the telemetry report message and will be written on the SIMTAPE. The output of the second type is punched directly on 5-level paper tape from STGR for an entire pass or for a period of time specified on the "GENERATE" card, whichever is smaller. The two types of output format are presented in the following paragraph.

3.4.1 Output 1200 Bit Line

	47			0
SIMBUF	NUMBER OF 160A WORDS			
+1	7777	SS13	MMMM	XOTT
+2	TTTT	NNNN	NNNN	NNNN
	NNNN	XEEE	BBBB	CCCC
+n	BBBB	CCCC	CKSUM	

where:

7777	= New Message Header
SS	= Station Number
13	= Telemetry Message Code
M's	= Telemetry Mode
T's	= System time, 6 most significant bits first, right justified, followed by 11 least significant bits in the next word, right justified.
X	= High-order bit=1 and second high-order bit=0 if event.
N's	= Fixed Format telemetry value
E's	= 10 least significant bits of associated system time (for simulation, all associated system time for event items will be equal).
B's	= Event ident with a leading zero.
C's	= Event value
CKSUM	= Arithmetic Complement Checksum for this message.

3.4.2 Output (5-Level Paper Tape)

The paper tape output will consist of the following:

a. Header Message

This is the Operational Telemetry Mode message sent to the Bird Buffer at the STA.

b. Telemetry Report Message

This is the message type #13 which is normally sent over the 1200 bps line.

c. Fade Message

This is the message sent to the STA when the vehicle fades or when the estimated time to track is zero.

Telemetry Report Header Message

H_{11}	H_7	H_3	S_5	S_1	A_3	M_{11}	M_7	M_3	C_{11}	C_7	C_3
H_{10}	H_6	H_2	S_4	S_0	A_2	M_{10}	M_6	M_2	C_{10}	C_6	C_2
H_9	H_5	H_1	S_3	A_5	A_1	M_9	M_5	M_1	C_9	C_5	C_1
H_8	H_4	H_0	S_2	A_4	A_0	M_8	M_4	M_0	C_8	C_4	C_0
P	P	P	P	P	P	P	P	P	P	P	P

H_{11} - H_0 = New Message Header (all 1's)

S_5 - S_0 = Station Number

A_5 - A_0 = Message Code (001010=12)

M_{11} - M_0 = Telemetry Mode

C_{11} - C_0 = Arithmetic Complement Checksum of the header message.

P's = Parity (odd)

Telemetry Report Message

H_{11}	H_7	H_3	S_5	S_1	A_3	M_{11}	M_7	M_3	B_{11}	B	T_{14}	B	T_7	T_3	N	N--C_{11}	D_7	D_3	B	I_7	I_3	E..K_{11}	K_7	K_3
H_{10}	H_6	H_2	S_4	S_0	A_2	M_{10}	M_6	M_2	B	B	T_{13}	T_{10}	T_6	T_2	N	N--B	D_6	D_2	B	I_6	I_2	E..K_{10}	K_6	K_2
H_9	H_5	H_1	S_3	A_5	A_1	M_9	M_5	M_1	B	T_{16}	T_{12}	T_9	T_5	T_1	N	N--D_9	D_5	D_1	B	I_5	I_1	E..K_9	K_5	K_1
H_8	H_4	H_0	S_2	A_4	A_0	M_8	M_4	M_0	B	T_{15}	T_{11}	T_8	T_4	T_0	N	N--D_8	D_4	D_0	I_8	I_4	I_0	E..K_8	K_4	K_0
P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P--P	P	P	P	P	P	P..P	P	P

H_{11} - H_0 = New Message Header (all 1's)

S_5 - S_0 = Station Number

A_5 - A_0 = Message Code (001011=13)

M_{11} - M_0 = Telemetry Mode

B's = Blanks (except B_{11}=C_{11}=1 if message contains "Event" only)

T_{16} - T_{11}= 6 most significant bits of system time, right justified.

T_{10} - T_0 = 11 least significant bits of system time, right justified.

N = Fixed Format telemetry items

C_{11} = 1 (ident bit of "Event" associated system time)

D_9 - D_0 = 10 least significant bits of associated system time.

I_8 - I_0 = Event ident

E's = Event value

K_{11} - K_0 = Arithmetic Complement Checksum for one message

P's = Parity (odd)

Telemetry Report Fade Message

K_{11}	K_7	K_3	----------	H_{11}	H_7	H_3	S_5	S_1	A_3	R_{11}	R_7	R_3	F_{11}	F_7	F_3
K_{10}	K_6	K_2	----(15 blanks)-----	H_{10}	H_6	H_2	S_4	S_0	A_2	R_{10}	R_6	R_2	F_{10}	F_6	F_2
K_9	K_5	K_1	----------	H_9	H_5	H_1	S_3	A_5	A_1	R_9	R_5	R_1	F_9	F_5	F_1
K_8	K_4	K_0	----------	H_8	H_4	H_0	S_2	A_4	A_0	R_8	R_4	R_0	F_8	F_4	F_0
P	P	P	----------	P	P	P	P	P	P	P	P	P	P	P	P

K_{11} - K_0 = Last message Arithmetic Complement Checksum

H_{11} - H_0 = New Message Header (all 1's)

S_5 - S_0 = Station Number

A_5 - A_0 = Message Code (010000=20)

R_{11} - R_0 = Fade Message Ident (010000000011=2003)

F_{11} - F_0 = Fade Message Arithmetic Complement Checksum

P's = Parity (odd)

4.0 METHOD

There are three main sub-modules in STGR that will generate raw telemetry data (8-bits). When these data points are plotted against time, they will represent three basic functions: Step Functions, Steady State, and Dynamic. To simulate the actual output from the TLM-Computer at the tracking station, six control subroutines are included. These subroutines will represent the six telemetry processing algorithms which are used to process raw FM/FM telemetry data at the tracking station. It is not the intention of this program to duplicate, exactly, the algorithms used at the tracking stations,

but to provide compressed data which, for program checkout purposes, appears to have been processed by these algorithms. A description of the methods employed to achieve this will be presented in the following paragraphs.

4.1 Algorithm #1--"Step Function"

This algorithm is applied only to "Event" item requests.

a. Input

1) Event Ident (P2)
2) Function Request - XXS (P3)
3) Threshold Value (P4)

b. Procedure

Using P3, the variable pattern (XXS), a "Step Function" data point, X_i, is generated, where X_i is assumed to be the average value of the last four samples and the value is assumed to be within the noise level. The absolute difference is formed between the old and the new point. If this difference exceeds the threshold value (P4), then X_i is the output and the old value will be replaced by X_i. To help the user select the appropriate variable pattern for the Step Function, the following table should be used.

Equation: $X_i = b_i + (-1)^P \Delta b_i$ for K_i seconds $(2 < X_i < 254)$

XX	b_i	Δb_i	K_i	P*
0	125	8	10	0
1	135	10	20	0
2	145	12	30	0
3	155	14	40	0
4	165	16	50	0
5	125	18	60	1
6	135	20	70	1
7	145	22	80	1
8	155	24	90	1
9	165	26	100	1

where XX = Pattern variable specification in P3 (XXS).

*P is updated by 1 every K_i seconds as t increases.

4.2 Algorithm #2--"Steady State and Dynamic Functions"

This algorithm can be applied to both "Event" and "Fixed Format" telemetry items.

a. Input

1) Event Ident (P2), if item is "Event".
2) Function Request - XXL or XXW (P3).
3) Number of seconds between reports (P4), if item is "Event".

b. Procedure

Using P3, a data point, X_i, is generated (use the same assumptions as Algorithm #1). The value X_i will always be within the high and low calibration limits ($2 \leq X_i \leq 254$). If the item is to be reported as an "Event", then X_i is the output for the interval specified (P4). If the item is to be reported as "Fixed Format", then X_i is reported every second. The following equations and tables are used:

"Steady State": $X_i = at + b - (pak)$

XX	a_i	b_i	X(min/max)	K_i	P*
0	2	8	248 max	120 sec.	0
1	4	8	248 max	60 sec.	0
2	8	8	248 max	30 sec.	0
3	16	8	248 max	15 sec.	0
4	32	8	248 max	7 sec.	0
5	-2	248	8 min	120 sec.	0
6	-4	248	8 min	60 sec.	0
7	-8	248	8 min	30 sec.	0
8	-16	248	8 min	15 sec.	0
9	-32	248	8 min	7 sec.	0

where XX = Pattern variable specification in P3 (XXL)
*P is updated by 1 for $X_i \geq 248$ or $X_i \leq 8$ as t increases.

"Dynamic Function": $X_i = a \sin(Kt) + b$

XX	a_i	b_i	X(max)	K
0	118	128	248	1/2 π
1	108	128	248	1/2 π
2	98	128	248	1/2 π
3	88	128	248	1/2 π
4	78	128	248	1/2 π
5	68	128	248	1/2 π
6	58	128	248	1/2 π
7	48	128	248	1/2 π
8	38	128	248	1/2 π
9	28	128	248	1/2 π

where XX = Pattern variable specification in P3 (XXW)

4.3 Algorithm #3--"Smoothing Function"

Same as Algorithm #2.

4.4 Algorithm #4--"Switch Setting-Unequal Increment"

This algorithm is applied to both "Event" and "Fixed Format" telemetry items.

a. Input

1) Event Ident (P2), if item is "Event"
2) Function Request - 00B (P3)
3) Number of seconds between reports (P4), if item is "Event".

b. Procedure

A "Steady State" data point, X_i, is generated with noise. Then a switch-setting, Y_i, is assigned to this point by the following criteria:

If $240 < X_i$, then switch-setting $Y_i = 17$ (4 bits)
$192 < X_i < 240$ " " $= 5$
$144 < X_i < 144$ " " $= 4$
$96 < X_i < 144$ " " $= 3$
$48 < X_i < 96$ " " $= 2$
$X_i < 48$ " " $= 1$

If this item is to be reported as a "Fixed Format" item, then Y_i is the 4-bit BCD output.

If this item is to be reported as an "Event" item, then Y_i is compared against Y_i-1. If $Y_i \neq Y_i$-1, then Y_i is reported and Y_i-1 is replaced by Y_i. If $Y_i = Y_i$-1, then P4 is tested to see if it is time for a periodic report. If it is, Y_i is reported.

4.5 Algorithm #5--"Switch Setting-Equal Increments"

Same as Algorithm #4, except that there are 10 switch settings instead of 5. The 10 switch settings are as follows:

If $240 < X_i$, then switch-setting $Y_i = 17$
$216 < X_i < 240$ " " $= 9$
$192 < X_i < 216$ " " $= 8$
$168 < X_i < 192$ " " $= 7$
$144 < X_i < 168$ " " $= 6$
$120 < X_i < 144$ " " $= 5$

$96 < X_i < 120$, then switch-setting $Y_i = 4$

$72 < X_i < 96$ " " = 3

$48 < X_i < 72$ " " = 2

$24 < X_i < 48$ " " = 1

$X_i < 24$ " " =12 (zero for BCD)

The rest is the same as Algorithm #4.

4.6 Algorithm #6--"Meter"

Input

1. Event Ident (P2)
2. Function Request - 00V (P3)
3. Bits repeated - V0000 (P4)

This algorithm is applied only to the "Event" item on a continuous FM/FM channel. No method has been developed to simulate the bit pattern of this type of telemetry read-out. For the present time, the vehicle velocity value is used and the output is every second. The output value is split into two, 160-A words. The first word contains the most significant 8 bits and the second word contains the least significant 8 bits, both right justified.

4.7 Noise Error

Computations during the generation of simulated raw telemetry data are based on a set of mathematical equations resembling telemetry signals when plotted against time. However, actual telemetry data points, as would be input from the TDP to the Bird Buffer at the STA, contain noise. In order to simulate telemetry data more realistically, noise error is introduced into the raw data prior to processing.

The first step in the addition of noise error is by the generation of a random number ranging from 0 to 7. Then the result is selectively substituted into the three least significant bits of the data point.

5.0 RESTRICTIONS

5.1 Hardware Components

a. 1604 Computer

b. Paper tape punch (5-level paper tape) if paper tape output is requested.

c. Three tape drives

5.2 Program Restriction

a. The program assumes no "Out of limit" reports.
b. There will be no on-line response to mode parameter changes.
c. STGR can only be operated with the SIPSA system.
d. Only 44 function input cards will be accepted.

6.0 TIMING

Operating time is a variable. The amount of time depends on the amount of data requested.

7.0 STORAGE REQUIREMENTS

	Decimal	Octal
Main Program (STGR)	492	754
Tables and Constants	1527	2767
Total Storage Requirement	2019	3743

8.0 VALIDATION TEST

8.1 Description of Input Parameters

In order to check out completely the telemetry data generation

program (STGR), many parameter checkout tests were completed. Included in this document, as Appendix B, are some of the results extracted from the final validation checkout run. In this test, 12 "Fixed Format" telemetry items and 11 "Event" items were specified. All 6 algorithms were used for this run. The output result in each telemetry report message can be identified as message type #13. Each of the telemetry items in the report can be identified by the following table of input specification summary.

Validation Test Input Specification Summary

ITEM NO.	TYPE OF REPORT	TELEMETRY FUNCTION	"EVENT" IDENT IN OCTAL	NO. OF BITS IN TELEMETRY VALUE	TIME BETWEEN REPORTS (SECONDS IN OCTAL)	"STEP FUNCTION" THRESHOLD IN OCTAL	"METER" NO. OF BITS REPEATED
1-4	Fixed Format	Steady State	-	8	-	-	-
5-10	" "	Dynamic	-	8	-	-	-
11-12	" "	Switch Setting	-	4	-	-	-
13	Event	*Steady State	0111	8	2 sec.		
14	"	"	0222	8	3 sec.		
15	"	"	0333	8	4 sec.		
16	"	Step	0444	8		2	
17	"	Step	0555	8		4	
18	"	*Dynamic	0666	8	5 sec.		
19	"	"	0777	8	10 sec.		
20	"	"	0122	8	12 sec.		
21	"	"Meter"	0616	16	-	-	16
22	"	Switch Setting	0717	4	5 sec.		
23	"	"	0727	4	5 sec.		

*There is no "out of limit" report from either Algorithm #2 or #3 for the "Event" items.

8.1.1 Hardware Configurations Control (from SIPSA Card)

a.	Input Control Cards:	Card Reader
b.	SIPSA System Master Tape:	Tape Unit No. 1
c.	SIMTAPE (final output):	Tape Unit No. 5
d.	Scratch tape (Utility):	Tape Unit No. 3
e.	On-line output:	Printer

8.1.2 Input Control Cards

The following cards were used for the validation test:

a. *SIPSA (SIPSA System Calling Card)

This card specifies the following input conditions:

1) Input source = 0 (card reader)
2) Tape Unit No. 5 to record "simulated" data.
3) Test I.D. = TMCHCK (6-character)
4) Type of SIMTAPE = BB (Bird Buffer)

b. START (Initialization Card)

This card specifies the program initial conditions prior to generation of data.

1) Station Number = 5
2) CCC "spigot" for Telemetry Computer = B
3) CCC "spigot" for Tracking Computer = A
4) Vehicle Number = 2041
5) Revolution Number = 8
6) Vehicle & System Start Time = 0
7) Telemetry Mode = 1234

c. SIMTLM (Telemetry Data Request Cards)

There are six telemetry item specification cards (see Appendix B).

d. GENERATE (Duration Card)

This card specifies, in seconds, the duration of the run. The output is one TIM message per second. The number used is 100.

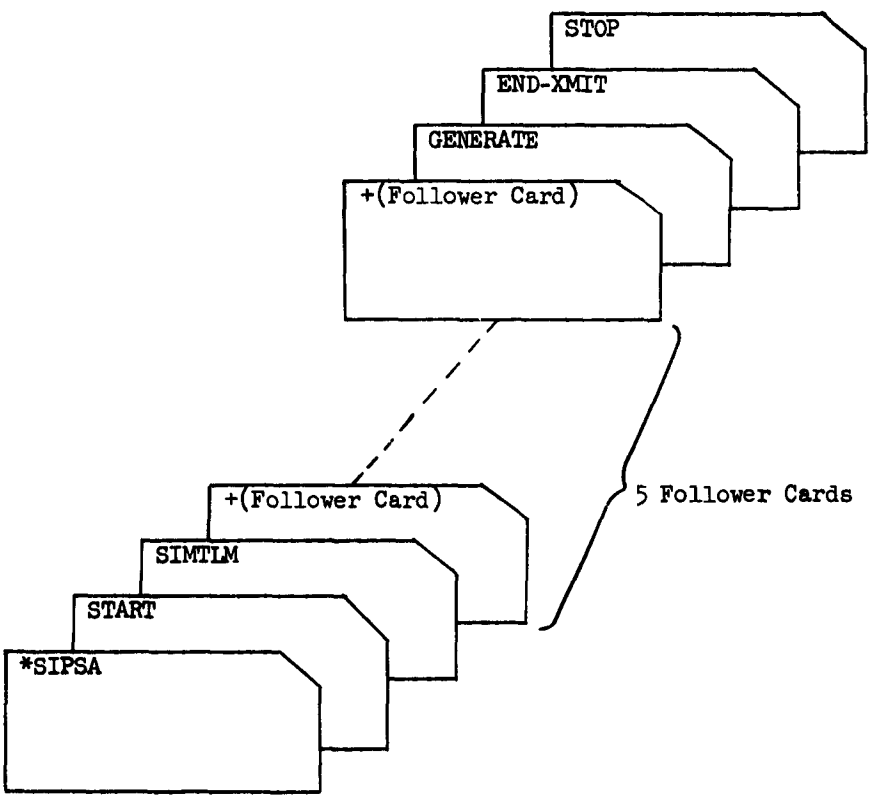
e. END-XMIT (End of Transmission)

This card will cause the SIPSA system to generate an "End-of-Pass" record.

f. STOP (SIMTAPE prepared)

This card terminates the SIPSA operation.

The above cards were arranged in the following sequence:



8.1.3 Running Procedure

a. Input Cards placed in the Card Reader
b. Tape Units Nos. 1, 3, and 5 ready
c. Card-Reader & Printer ready
d. Auto-load
e. Repeat above test with paper tape output.

8.2 Expected Output from Test

a. On-line printout indicating all cards read in.
b. SIMTAPE prepared on Tape Unit No. 5.
c. Total number of reports = 100.

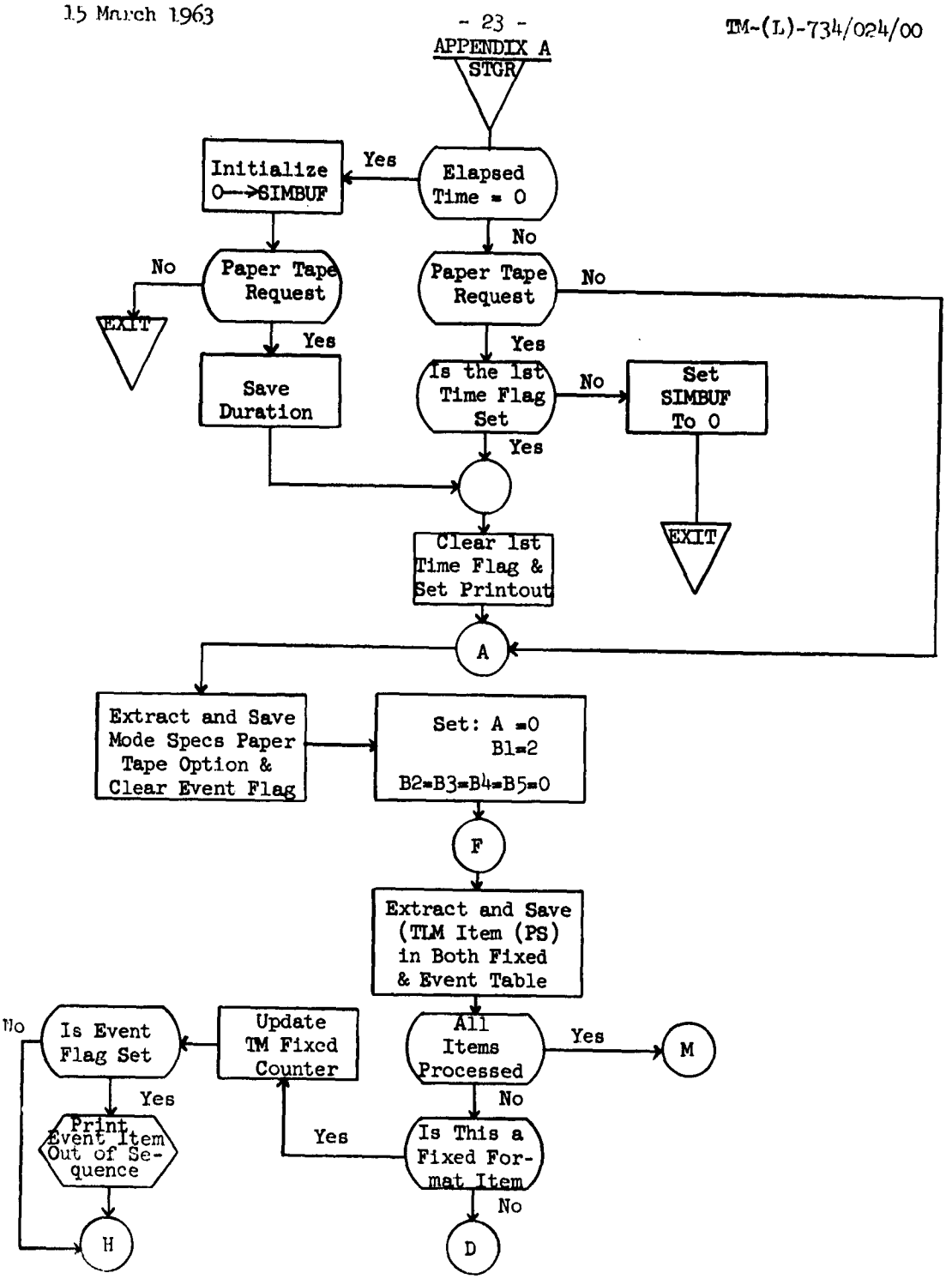
9.0 REFERENCES

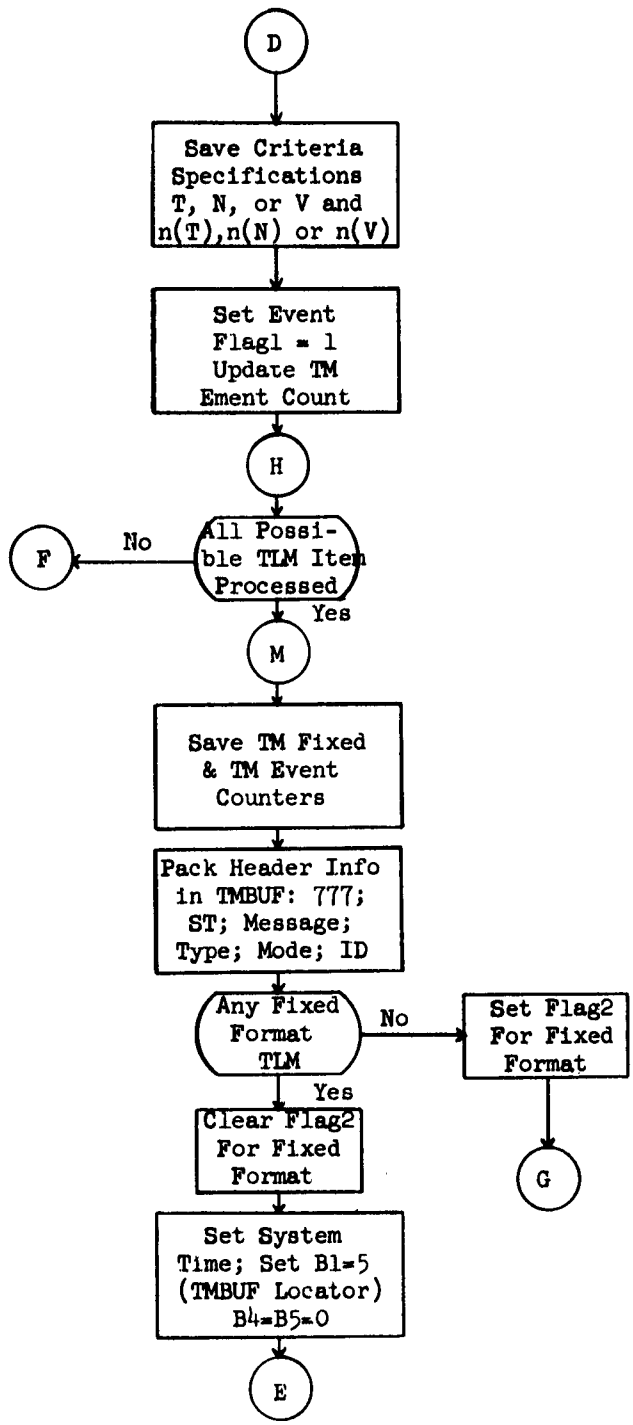
a. TM-(L)-734/015/00, Computer Program Design Specifications for the Simulation of the Augmented SCF Environment at the STA and CPDC (Milestone 4), System Development Corporation, November 1962.

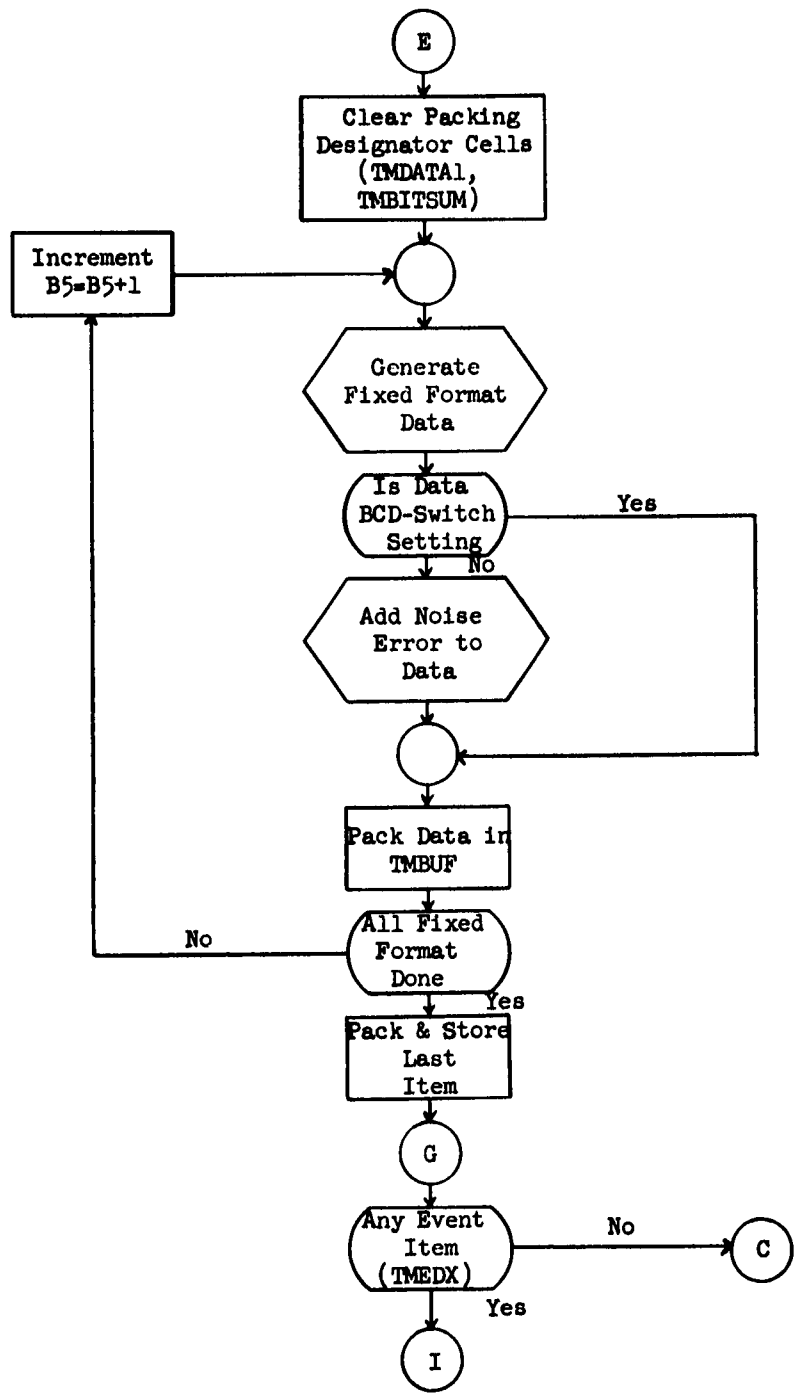
b. N-(L)-19083/007/00*, Program Interfaces (FM/FM Telemetry Algorithms), System Development Corporation, December 1962.

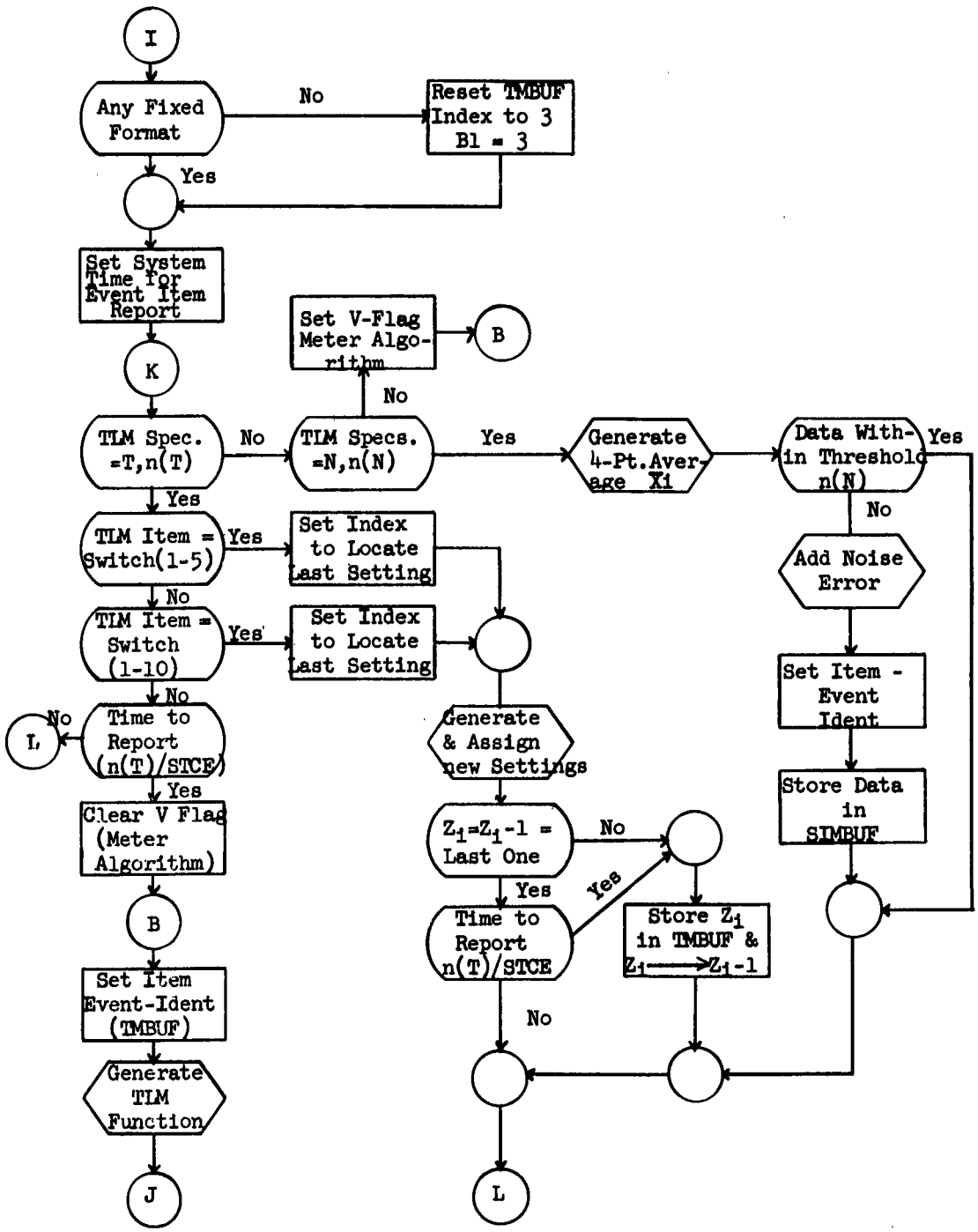
c. TM-(L)-949/000/00, Telemetry Data Flow for the Augmented SCF, System Development Corporation, January 1963.

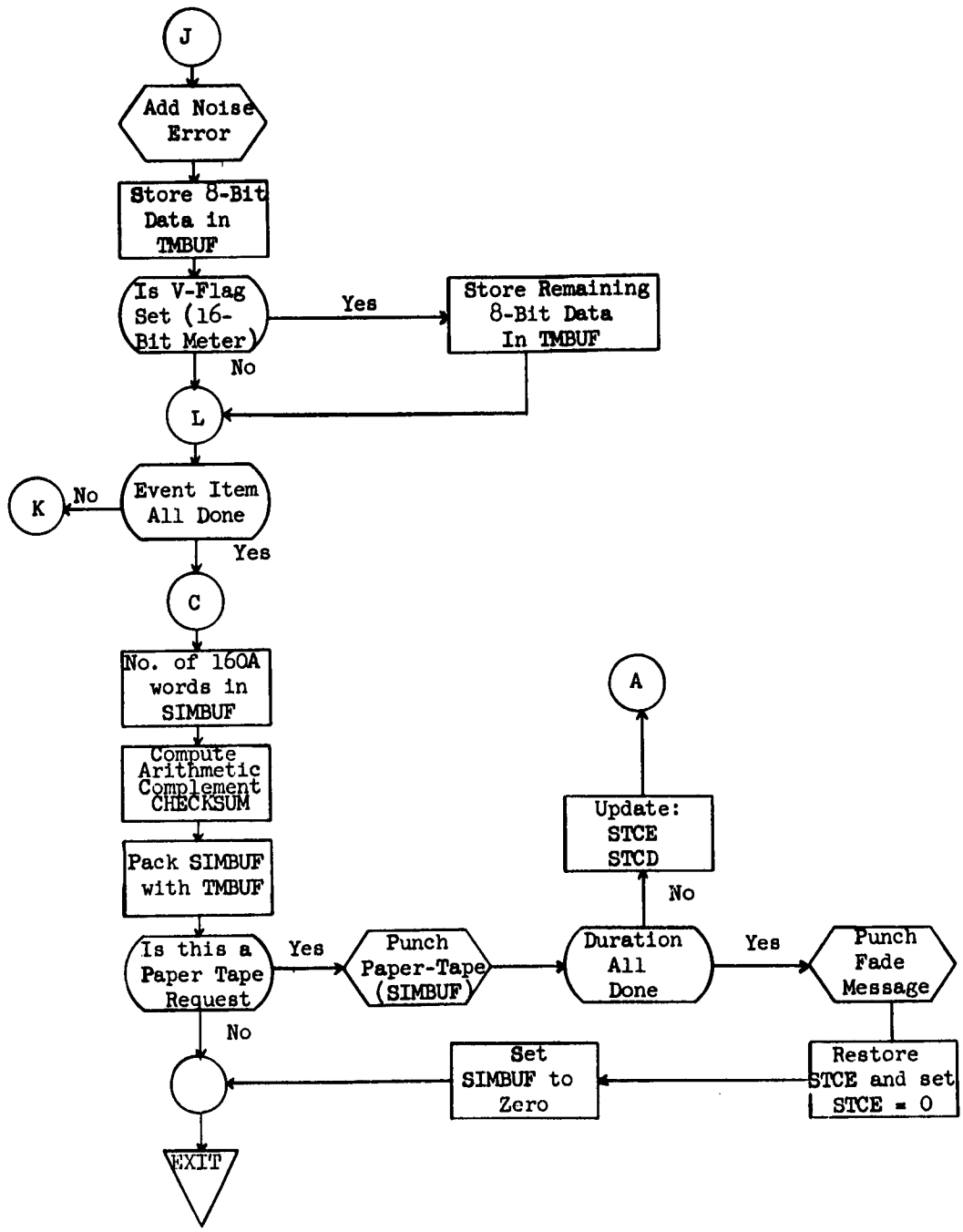
*An internal document not available to non-SDC personnel.


APPENDIX A
STGR
Elapsed Time = 0
Yes
Initialize 0→SIMBUF
No
Paper Tape Request
No
EXIT
Yes
Save Duration
Paper Tape Request
No
Yes
Is the 1st Time Flag Set
No
Set SIMBUF To 0
Yes
EXIT
Clear 1st Time Flag & Set Printout
A
Extract and Save Mode Specs Paper Tape Option & Clear Event Flag
Set: A =0
B1=2
B2=B3=B4=B5=0
F
Extract and Save (TLM Item (PS) in Both Fixed & Event Table
All Items Processed
Yes
M
No
Is This a Fixed Format Item
Yes
Update TM Fixed Counter
No
D
Is Event Flag Set
No
Yes
Print Event Item Out of Sequence
H


D
Save Criteria Specifications T, N, or V and n(T),n(N) or n(V)
Set Event Flag1 = 1 Update TM Ement Count
H
All Possi-ble TLM Item Processed
No
F
Yes
M
Save TM Fixed & TM Event Counters
Pack Header Info in TMBUF: 777; ST; Message; Type; Mode; ID
Any Fixed Format TLM
No
Set Flag2 For Fixed Format
G
Yes
Clear Flag2 For Fixed Format
Set System Time; Set B1=5 (TMBUF Locator) B4=B5=0
E


E
Clear Packing Designator Cells (TMDATA1, TMBITSUM)
Increment B5=B5+1
Generate Fixed Format Data
Is Data BCD-Switch Setting
Yes
No
Add Noise Error to Data
Pack Data in TMBUF
All Fixed Format Done
No
Yes
Pack & Store Last Item
G
Any Event Item (TMEDX)
No
C
Yes
I


I
Any Fixed Format
No
Reset TMBUF Index to 3 B1 = 3
Yes
Set System Time for Event Item Report
K
Set V-Flag Meter Algorithm
B
No
TIM Spec. =T,n(T)
No
TIM Specs. =N,n(N)
Yes
Generate 4-Pt. Average Xi
Data Within Threshold n(N)
Yes
No
Add Noise Error
Set Item - Event Ident
Store Data in SIMBUF
Yes
TIM Item = Switch(1-5)
Yes
Set Index to Locate Last Setting
No
TIM Item = Switch (1-10)
Yes
Set Index to Locate Last Setting
No
Time to Report (n(T)/STCE)
No
L
Yes
Clear V Flag (Meter Algorithm)
B
Set Item Event-Ident (TMBUF)
Generate TIM Function
J
Generate & Assign new Settings
Zi=Zi-1 = Last One
No
Yes
Time to Report n(T)/STCE
Yes
Store Zi in TMBUF & Zi ⟶ Zi-1
No
L


J
Add Noise Error
Store 8-Bit Data in TMBUF
Is V-Flag Set (16-Bit Meter)
Yes
Store Remaining 8-Bit Data In TMBUF
No
L
K
No
Event Item All Done
Yes
C
No. of 160A words in SIMBUF
Compute Arithmetic Complement CHECKSUM
Pack SIMBUF with TMBUF
Is this a Paper Tape Request
Yes
Punch Paper-Tape (SIMBUF)
Duration All Done
Yes
Punch Fade Message
No
Update: STCE STCD
A
Restore STCE and set STCE = 0
Set SIMBUF to Zero
EXIT

APPENDIX B

ON-LINE PRINTOUT OF INPUT CARDS

```
START     01    A B  02041   0008   1234
SIMTLM    1234       01L            02L            03L            04L
+                    01W            02W            03W            04W
+                    05W            06W            00B            00C
+              0111 01L T0002 0222 02L T0003 0333 03L T0004 0444 04S N0002
+              0555 05S N0004 0666 01W T0005 0777 02W T0010 0122 03W T0012
+              0616 00V V0016 0717 00B T0005 0727 00C T0005
GENERATE  0100
END-XMIT
STOP
```

A SIMULATED DATA TAPE HAS BEEN PREPARED. THE TAPE HAS BEEN REWOUND AND MARKED WITH AN END-OF-FILE.

BB TAPE PROCESSED BY DROPSA

TAPE I.D. = TMCHCK

STATION	VEHICLE NO.	REVOLUTION NO.	PREPASS OPTION	TRK COMPUTER NO.	TLM COMPUTER NO.	TLM MODE
HULA	2041	8.0	0	1	2	1234

SITE-ON-LINE TIME MESSAGE

OCTAL

1.	7777	STATION
2.	0517	
3.	0000	SYSTEM TIME
4.	0000	0 SEC
5.	0000	CONTROL*STATUS
6.	7260	

OCTAL DUMP OF MESSAGE CONTAINING 26 WORDS

1.	2.	3.	4.	5.	6.	7.	8.
7777	0513	1234	0000	0001	0301	2431	1230
9.	10.	11.	12.	13.	14.	15.	16.
7611	4230	1601	4021	0400	4001	0444	0265
17.	18.	19.	20.	21.	22.	23.	24.
0555	0151	0616	0000	0000	0717	0001	0727
25.	26.						
0001	7010						

OCTAL DUMP OF MESSAGE CONTAINING 20 WORDS

1.	2.	3.	4.	5.	6.	7.	8.
7777	0513	1234	0000	0002	0421	4453	2231
9.	10.	11.	12.	13.	14.	15.	16.
4620	4510	6611	4221	0400	4002	0111	0021
17.	18.	19.	20.				
0616	0000	0000	4541				

OCTAL DUMP OF MESSAGE CONTAINING 18 WORDS

1.	2.	3.	4.	5.	6.	7.	8.
7777	0513	1234	0000	0053	5427	3731	1232
9.	10.	11.	12.	13.	14.	15.	16.
5641	4631	4224	4322	2000	4053	0616	0000
17.	18.						
0000	1006						

OCTAL DUMP OF MESSAGE CONTAINING 26 WORDS

1.	2.	3.	4.	5.	6.	7.	8.
7777	0513	1234	0000	0054	5627	5751	2233
9.	10.	11.	12.	13.	14.	15.	16.
0254	5131	4631	4563	2400	4054	0111	0273
17.	18.	19.	20.	21.	22.	23.	24.
0333	0351	0616	0000	0000	0717	0003	0727
25.	26.						
0005	6213						

OCTAL DUMP OF MESSAGE CONTAINING 26 WORDS

1.	2.	3.	4.	5.	6.	7.	8.
7777	0513	1234	0000	0055	5710	2411	3233
9.	10.	11.	12.	13.	14.	15.	16.
7661	5232	1631	4423	2400	4055	0222	0205
17.	18.	19.	20.	21.	22.	23.	24.
0666	0311	0616	0000	0000	0717	0003	0727
25.	26.						
0005	3604						

OCTAL DUMP OF MESSAGE CONTAINING 20 WORDS

1.	2.	3.	4.	5.	6.	7.	8.
7777	0513	1234	0000	0056	6030	4433	4234
9.	10.	11.	12.	13.	14.	15.	16.
0670	5512	6641	4623	2400	4056	0111	0301
17.	18.	19.	20.				
0616	0000	0000	5032				

OCTAL DUMP OF MESSAGE CONTAINING 20 WORDS

1.	2.	3.	4.	5.	6.	7.	8.
7777	0513	1234	0000	0127	3576	0711	3274
9.	10.	11.	12.	13.	14.	15.	16.
4701	5412	6245	4624	4000	4127	0222	0341
17.	18.	19.	20.				
0616	0000	0000	6535				

OCTAL DUMP OF MESSAGE CONTAINING 24 WORDS

1.	2.	3.	4.	5.	6.	7.	8.
7777	0513	1234	0000	0130	3636	4730	4314
9.	10.	11.	12.	13.	14.	15.	16.
6701	5632	7641	4624	4000	4130	0111	0171
17.	18.	19.	20.	21.	22.	23.	24.
0333	0330	0777	0324	0616	0000	0000	3672

OCTAM DUMP OF MESSAGE CONTAINING 18 WORDS

1.	2.	3.	4.	5.	6.	7.	8.
7777	0513	1234	0000	0131	3637	3751	5234
9.	10.	11.	12.	13.	14.	15.	16.
5701	5632	4244	4724	4000	4131	0616	0000
17.	18.						
0000	2734						

OCTAL DUMP OF MESSAGE CONTAINING 30 WORDS

1.	2.	3.	4.	5.	6.	7.	8.
7777	0513	1234	0000	0132	4020	5411	6234
9.	10.	11.	12.	13.	14.	15.	16.
4304	5732	4641	4764	4000	4132	0111	0203
17.	18.	19.	20.	21.	22.	23.	24.
0222	0011	0666	0341	0122	0310	0616	0000
25.	26.	27.	28.	29.	30.		
0000	0717	0004	0727	0010	4436		

15 March 1963

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UNCLASSIFIED

System Development Corporation,
Santa Monica, California
1604 SIMULATION PROGRAM DESCRIPTIONS,
MILESTONE 11 THE SIMULATED TELEMETRY
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Scientific rept., TM(L)-734/024/00, by
J. Ng. 15 March 1963, 31p., 3 refs.
(Contract AF 19(628)-1648, Space Systems
Division Program, for Space Systems
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DESCRIPTORS: Programming (Computers).
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Reports that the Simulated Telemetry Data Generation Control Program (STGR) has been designed to provide realistic telemetry data (Fixed Format and Event Items) under card input control. Also reports that the simulated data will be packed in the same format as the Telemetry Report Message (Message Type #13). UNCLASSIFIED